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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,184	02/09/2004	Kia Silverbrook	MTB36US	8429

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AUSTRALIA

EXAMINER

FIDLER, SHELBY LEE

ART UNIT	PAPER NUMBER
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2861

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/773,184	Applicant(s) SILVERBROOK, KIA	
	Examiner Shelby Fidler	Art Unit 2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 January 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 18-35, 37-52 and 54 is/are rejected.
- 7) ☒ Claim(s) 9, 17, 18, 23, 28, 36, 37 and 53 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/25/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 9, 18, 23, 28, and 37 are objected to because of the following informalities:

Regarding claims 9 and 28, line 3 recites "said part," which has no antecedent basis.

Regarding claims 18 and 37, line 1 recites, "each heater element is *substantially* covered . . . such that the coating is seamless." This statement is unclear since a substantially covered element would not be seamless.

Regarding claims 23, the term "support" is unclear and indefinite since there is no context to determine the type of support that the system is offering.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Silverbrook (US 6019457).

Silverbrook teaches the following:

*regarding claims 1, 19, and 38, an inkjet printhead (*col. 5, lines 60-61*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*col. 1, lines 64-65*), each defining a nozzle aperture having a central axis (*Z-axis, col. 2, lines 53-56*);

a bubble forming chamber corresponding to each of the nozzles respectively (*chamber 113, Figure 9*);

at least one heater element disposed in each of the bubble forming chambers respectively (*heater 120, Figure 9*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); wherein,

the heater element is spaced from the central axis (*Z-axis through nozzle 445, Figure 13*) and defines a current path substantially around the central axis (*col. 9, lines 20-23 with Figure 13*);

***further regarding claim 38**, supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (*col. 12, lines 59-61*)

***regarding claims 2, 20, and 39**, the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*) and the heater element has arcuate sections that are concentric with the circular cross section (*heater elements 441 and 443, Figure 13*).

***regarding claims 4, 22, and 41**, the heater elements are ring-shaped (*heater elements 441 and 443, Figure 13*), and that they extend between electrodes mounted on opposite sides of the bubble forming chamber (*connections 442 and 443, Figure 13*).

***regarding claims 5, 24, and 42**, the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 9, lines 26-30*).

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***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and to be a page-width printhead (*col. 2, lines 19-22*).

***regarding claims 8, 27, and 44**, each heater element is configured such that actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29, and 46**, the printhead comprises a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations*

show that the density exceeds 10,000 per square cm: $\frac{20\text{nozzles}}{0.0016384\text{cm}^2} = 12207 \frac{\text{nozzles}}{\text{cm}^2}$)

***regarding claims 13, 32, and 50**, a structure that is formed by chemical vapor deposition, the nozzles being incorporated on the structure (*col. 5, lines 47-49*)

***regarding claims 14, 33, and 49**, a structure which is less than 10 microns thick, the nozzles being incorporated on the structure (*col. 9, lines 8-10*)

***regarding claim 23**, support the bubble forming liquid in thermal contact with each heater element (*col. 17, lines 37-43*), and to support the ejectable liquid adjacent each nozzle (*col. 17, lines 37-40*)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Moon et al. (US 6761433 B2).

Silverbrook teaches all claim limitations except the following:

***regarding claims 3, 21, and 40,** the heater element is omega-shaped and extends between adjacent electrodes in the side of a bubble forming chamber

***regarding claims 11, 30, and 47,** each heater element has two opposite sides and is configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element

Moon et al. teaches the following:

***regarding claim 3, 21, and 40,** the heater element is omega-shaped (*resistors 104, Figure 5A*) and extends between adjacent electrodes in the side of a bubble forming chamber (*col. 2, lines 34-37 read with electrodes 105, Figure 9*)

***regarding claims 11, 30, and 47,** each heater element has two opposite sides (*unreferenced elements, illustrated as black blocks, Figures 10-13*) and is configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element (*Figures 11-12*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's ring-shaped heaters with Moon's omega-shaped heaters. The motivation for doing so, as taught by Moon, is to provide another embodiment of a resistor that is spaced from the central axis of the nozzle (*col. 6, lines 4-8*).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Anagnostopoulos et al. (US 6502925 B2).

Silverbrook teaches the following:

***regarding claims 15, 34, and 51,** a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 7, lines 42-44*), a plurality of heater elements being disposed within each chamber (*col. 9, lines 20-23 with heaters 120, Figure 12*)

Silverbrook teaches all claim limitations except the following:

***regarding claims 7, 26,** the heater element is predominantly formed from titanium nitride

***regarding claims 15, 34, and 51,** the heater elements within each chamber being formed on different respective layers to one another

***regarding claims 16, 35, and 52,** each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50

***regarding claims 18, 37, and 54,** each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless

Anagnostopoulos et al. teaches the following:

***regarding claims 7, 26,** the heater element is predominantly formed from titanium nitride (*col. 10, lines 36-38*)

***regarding claims 15, 34, and 51,** the heater elements within each chamber being formed on different respective layers to one another (*col. 8, lines 36-38*)

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***regarding claims 16, 35, and 52**, each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54**, each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's heater elements to be formed predominantly from Anagnostopoulos' Titanium Nitride heater composition. The motivation for doing so, as taught by Chan (US 5870121), is to take advantage of TiN's highly stable and highly resistive characteristics (*col. 5, lines 11-22*).

Claims 9, 28, and 45 are rejected as best understood under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Otsuka et al. (US 5485179).

Silverbrook teaches all the claimed limitations except for the following:

***regarding claims 9, 28, and 45**, the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point

Otsuka et al. teaches the following:

***regarding claims 9, 28, and 45**, the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less

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than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (*col. 13, lines 21-28 shows that the energy required to heat the heater is less when the ambient temperature is high, and more when the ambient temperature is low; therefore, Otsuka teaches that it would take less energy to eject a drop of ink than it would to heat ink from an ambient temperature to a boiling temperature*).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's invention with Otsuka's heating configuration. The motivation for doing so, as taught by Otsuka, is to control the temperature of the recording head based on the present ambient temperature (*col. 12, lines 41-49*).

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Campbell et al. (US 4870433).

Silverbrook expressly teaches all claim limitations except the following:

***regarding claims 12, 31, and 48,** the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element

Campbell et al. teaches the following:

***regarding claims 12, 31, and 48,** the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (*col. 3, lines 60-64*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to use the heater element design of Campbell to modify Silverbrook's invention. The

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motivation for doing so, as taught by Campbell, is to prevent cavitational damage to the heater elements (*col. 3, lines 14-23*).

Allowable Subject Matter

Claims 17, 36, and 53 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The primary reason for the indication of allowable subject matter of claim 17 is the inclusion of the limitation of an inkjet printhead that includes each heater element having a solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop. It is this limitation found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for the indication of allowable subject matter of claim 36 is the inclusion of the limitation of an inkjet printhead that includes each heater element having a solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop. It is this limitation found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for indicating allowable subject matter of claim 53 is the inclusion of the method step of ejecting drops of ejectable liquid that includes heating at least one heater element comprising a mass of less than 10 nanograms of solid material of each such heater element to a temperature above the boiling point. It is this step found in of the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tsung Pan (US 4894664) teaches of heating elements that are in the form of cantilever beams. Kubby (US 5706041) teaches having a suspended heating element and having heating elements on two different layers. Abe et al. (US 4914562) teaches heating elements that are constructed to avoid collapsing bubbles. Nagashima (US 4623901) teaches of ring-shaped heating element arrays, wherein the diameters of the heating elements are different, and are arranged concentrically.

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Communications with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shelby Fidler

SLF

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PRIMARY EXAMINER